TWO TEAM MEMBERS study a map of one of the monitoring areas. In the background, members of a field team are bringing in a fish trap. BN–23872

TEAMWORK ON THE DELTA

ARS scientists study the impact of pesticides on the environment

The heavily farmed Mississippi River Delta region is being studied by the U.S. Department of Agriculture to learn more about residues resulting from normal agricultural use of pesticides. By recording the pesticides used in representative areas, and chemically analyzing samples of soil, water, crops, livestock, and wildlife taken from those areas, researchers hope to determine the rate of accumulation or depletion of residues.

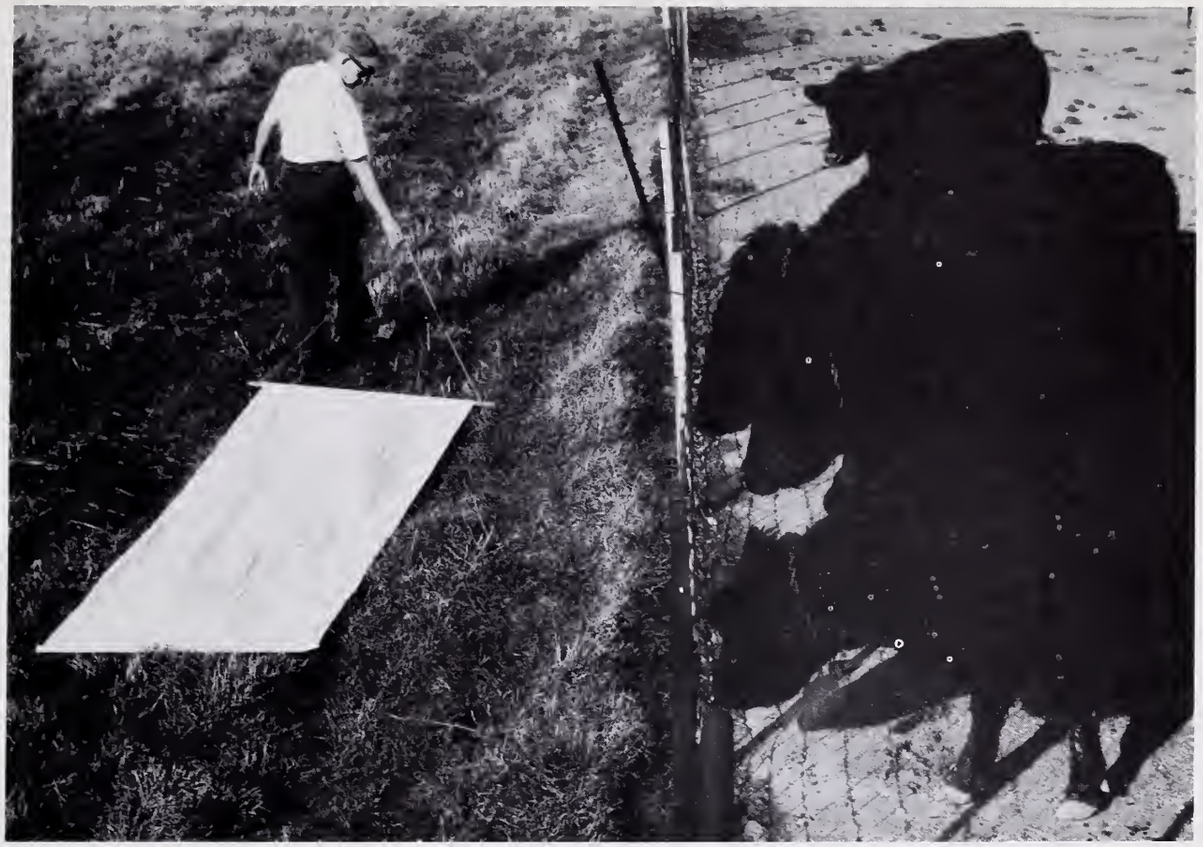
The Delta is the first of several major agricultural regions to come under close scrutiny by USDA's Agricultural Research Service in an effort to pinpoint the effects of pesticides on the total environment.

Farmers need effective means of protecting their crops and livestock from destructive pests to provide consumers an abundance of high-quality food and other farm products. At the same time, man and his environment—air, soil, water, and wildlife—must be protected from harmful pesticide residues.

The monitoring program was started in May 1964. Five locations were selected —two in Arkansas and three in Mississippi. Cotton, rice, and soybeans are grown in these locations. Each location consists of two areas containing similar crops but with as much difference in pesticide use as possible. Covering approximately one square mile, each area has at least one water source—pond, stream, or drainage ditch—and generally a wildlife habitat.

U.S. Department of Agriculture • Agricultural Research Service • Picture Story No. 180 • March, 1965

Field Team Collects Samples At Each Site



TICK DRAGS are conducted in areas frequented by livestock. Ticks on the canvas will be counted after it has been pulled a specified distance. BN–23883

Local Farmers Help

A field team, supervised by an entomologist, is stationed at each location to collect samples and record pesticide use.

Records of pesticides used are maintained by working with local farmers. The field team notes all current pesticide treatments on the study areas, including amounts of material and methods of application. In addition, an attempt is being made to reconstruct pesticide- and land-use records on the plots for the past 10 years.

To measure the effect of these pesticides, the team gathers samples of soil, water, sediment, crops, and certain land and water animals. These samples are all sent to a laboratory in Gulfport, Miss., where they are chemically analyzed for pesticide content. The team also makes counts of many non-target insects to see what effect pesticides have had on the insect population. These include both nuisance insects, such as flies, ticks, and mosquitos, and beneficial insects, such as the honeybee.

Soil samples are collected from each of the subdivisions of every study area. Each subdivision is a single crop, a pasture, or a wooded area. The soil samples are taken with a hand-operated corer thrust into the ground to a 3-inch depth. The final test sample consists of a composite of 25 cores taken at different places in the subdivision. The cores are thoroughly mixed together, then one gallon of the soil mixture is sealed in a can for shipping to the laboratory. Soil samples are taken once a month during the growing season and every three months in the off-season.

Sediment samples are taken from the bottom of all ponds, streams, and ditches in the study areas.

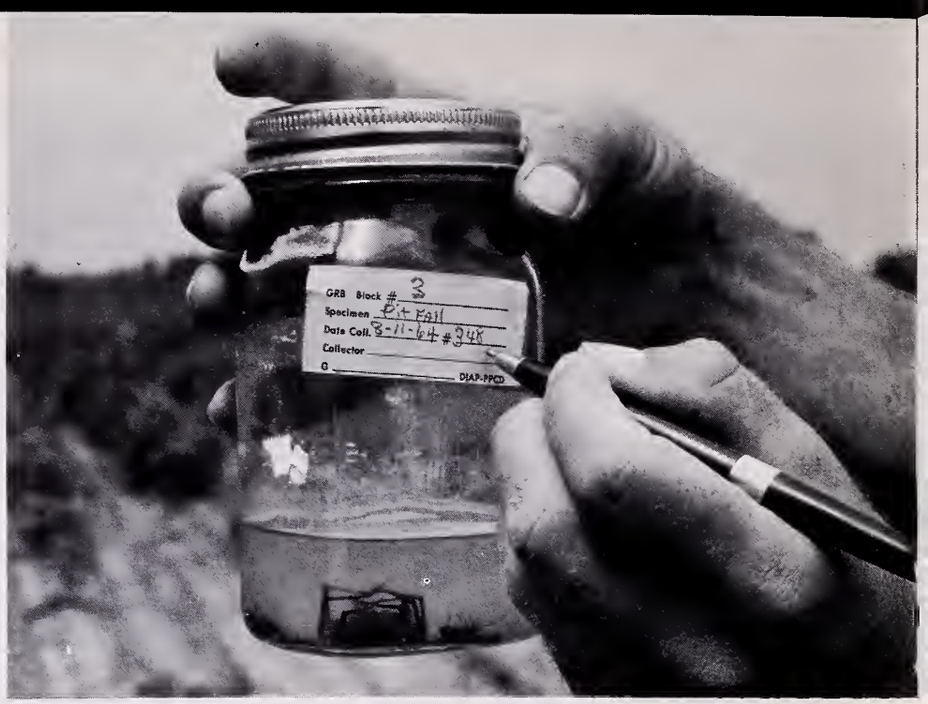
A portable bilge pump connected to a sterilized glass carboy is used for collecting water samples. In addition to regular monthly samplings, water samples are drawn after rains to collect runoff water. The carboy is carefully sealed to avoid contamination after collection.

Crop Samples Taken

Crop samples are collected near the time of harvest. At least 10 pounds of the crop, either foliage or fruit, is gathered at random in a field and placed in a plastic bag. Pasture and other forage samples are collected periodically in the same manner.

The field personnel trap insects, fish, frogs, turtles, mice, and other animals in the study areas. These animals, as are all other perishable samples, are packed in dry ice for shipping to the laboratory.

SEDIMENT AND SOIL samples are collected with a hand-operated corer. Twenty-five cores are collected in a bucket and mixed together by a sifting process. One gallon of the mixture is then shipped to the laboratory in a sealed can. BN–23886; BN–23908



ANIMAL AND INSECT TRAPS are set in the study areas. The trap on the left will capture mice without killing them. Above, the catch from an insect pitfall trap is tagged before being sent to the laboratory. The pitfall trap is formed by pouring alcohol into a paper cup which has been buried, its rim level with the ground. Crawling insects fall in and are killed by the alcohol. BN–23890; BN–24121

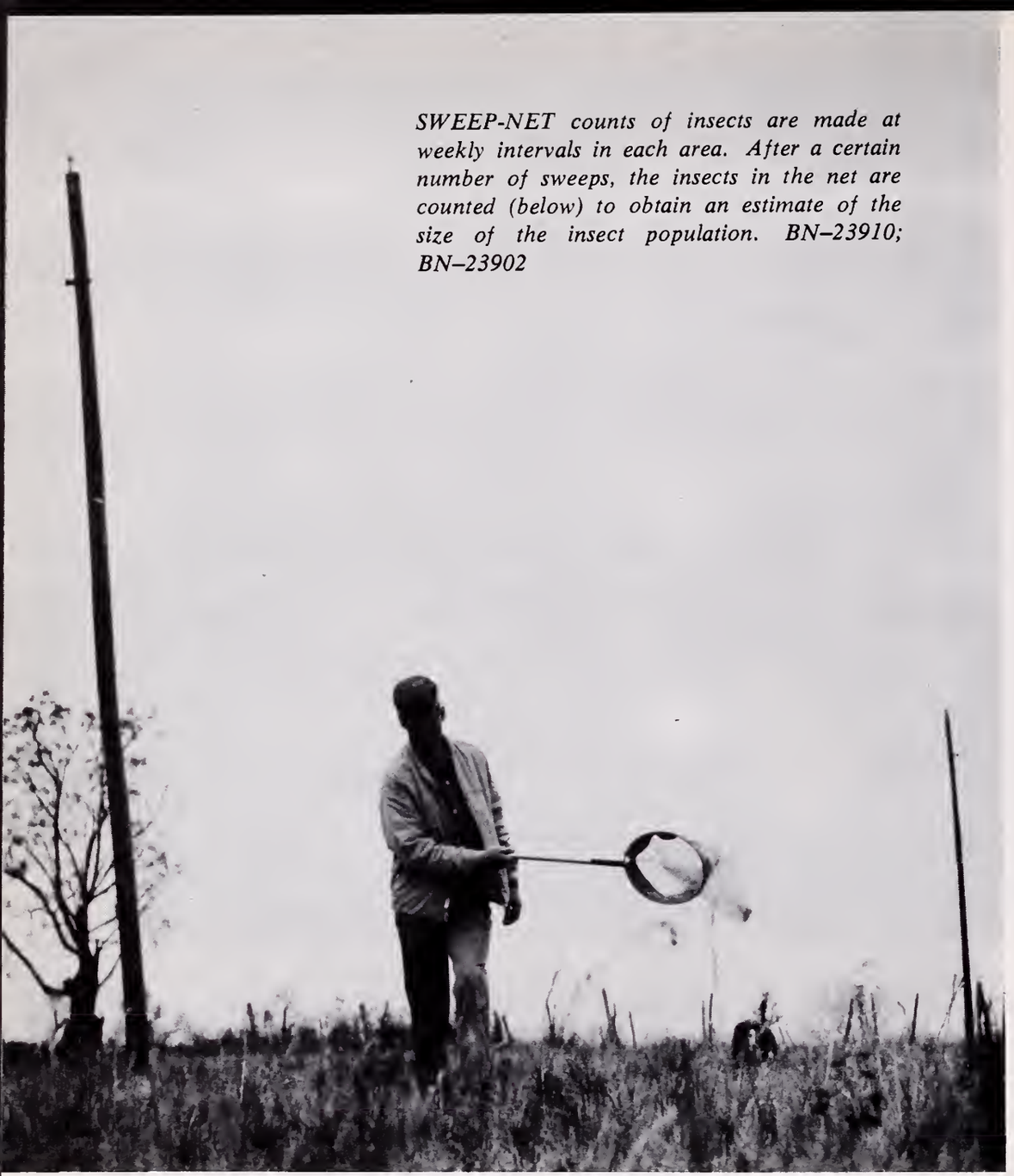
WATER SAMPLE is taken from a pond with a portable pump connected to a sterilized carboy. Water will be taken at random from different parts of the pond to form the sample. BN–23898

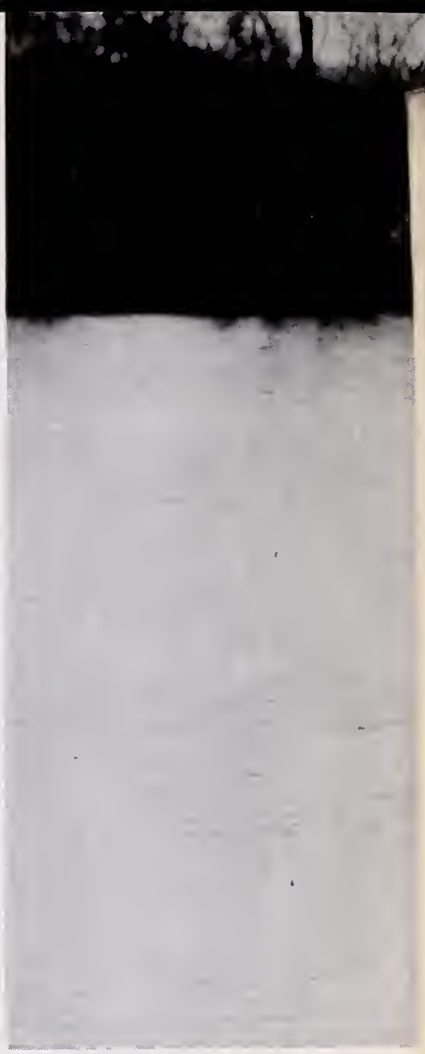
HONEYBEES are maintained on each area so researchers can learn the effect of pesticides on bees and honey production. When bees die, their hive mates carry them outside. The box is placed to receive dead bees as they are dropped. These bees are picked up daily, counted, and sent to the laboratory for analysis. BN–24122

FORAGE and crop samples are collected at random in a field. At least 10 pounds of the material are gathered and sealed in a plastic bag for shipment to the laboratory. BN–23889

Magazines and newspapers may obtain glossy prints of these photographs in any size up to 8x10 from the Photography Division, Office of Information, U.S. Department of Agriculture, Washington, D. C., 20250. Others may purchase prints in any size from the same address. Prints in 8x10 size are $1.15 each. Specify title and number of this publication.

SWEEP-NET counts of insects are made at weekly intervals in each area. After a certain number of sweeps, the insects in the net are counted (below) to obtain an estimate of the size of the insect population. BN–23910; BN–23902





MEMBERS of the field team remo and placed, with an identifying tag from the time of collection until the

SWEEP-NET counts of insects are made at weekly intervals in each area. After a certain number of sweeps, the insects in the net are counted (below) to obtain an estimate of the size of the insect population. BN–23910; BN–23902

A FISH TRAP is drawn from a pond in one of the study areas. Minnows and pan fish, turtles, tadpoles, frogs, and crayfish are trapped and sent to the laboratory in an effort to determine if there are residues present in the natural life of the ponds and streams. BN–23873

MEMBERS of the field team remove the fish from the trap and place them in a plastic bag. This bag is sealed and placed, with an identifying tag, in dry ice for shipment to the laboratory. All perishable samples are frozen from the time of collection until they are ready for processing at the laboratory. BN–23875; BN–23876; BN–23878

Samples Are Trucked To Main Laboratory For Chemical Analysis

A SPECIAL TRUCK with a dustproof body arrives at the laboratory in Gulfport, Miss., with a load of samples from the monitoring locations. BN–23726

A specially equipped courier truck picks up samples at each of the five locations once a week and carries them to a laboratory set up to analyze the samples at Gulfport, Miss.

The truck, which has a dustproof body, carries a supply of dry ice to keep perishable samples frozen enroute. To avoid contamination, the truck is used solely for transportation of samples and is thoroughly washed after each run.

When samples arrive at the laboratory, they are carefully logged in as to place and time collected and given code numbers. Processing starts immediately.

Each water sample is placed in a larger bottle with a solvent solution of redistilled pentane and ether. This solution will absorb any pesticides in the sample. To thoroughly mix the solvent, giving it an opportunity to absorb all the pesticides in the water, the bottle is rotated on two motor-driven rollers for 20 minutes. The solvent is then drawn off in a small container for chemical analysis.

WATER SAMPLES (right) are processed first, since chemicals in them are more unstable than in other samples. After 1,000 milliliters of a solvent solution of redistilled pentane and ether is added to the sample, the container is turned on these two rollers for 20 minutes to thoroughly mix the solution with the water. The pentane and ether solution absorbs any residues in the water and is drawn off for analysis at the end of the mixing period. BN–23722

THE TRUCK is unloaded immediately, and processing starts on the samples. The can in foreground contains a soil sample. BN–23733

Processing Soil Samples

In processing soil samples, a 100-gram portion of the sample is weighed out and placed in a one-half gallon fruit jar with a solution of hexane and isopropyl alcohol. This solution will dissolve and absorb any pesticides in the soil. The soil and solvent mixture is rotated on a ferris-wheel-type device for four hours to insure absorption of the pesticide residues.

The mixture is then filtered, and the extract containing any residue is drawn off in a bottle.

Procedures differ slightly for crop and wildlife samples, but the result is the same—any pesticide residues are extracted in a solution which can be chemically analyzed.

CODE NUMBERS are placed on all samples to identify them during the laboratory processes. Here, cottonseed and soybean seed samples are placed in quart jars and coded. BN–23732

SOIL SAMPLES, in quart jars, are mixed with hexane and isopropyl alcohol and turned for 4 hours on these ferris-wheel-devices, built for the purpose. This allows the hexane and isopropyl alcohol to absorb any residues in the soil. BN–23728

AFTER TURNING on the ferris wheels, the samples are filtered and rinsed with distilled water (left), leaving only an extract containing any pesticide residues on top of the distilled water in these containers. BN–23710

THE DISTILLED WATER, which settles to the bottom, is drained out of the containers (below). Then, the extract is placed in the small dark bottles, ready to be analyzed for pesticide content. BN–23714

Several methods are used for determining the kind and amount of any pesticide residues that are in the extracts. Usually the extracts are injected into a highly sensitive gas chromatograph machine (on next page). Other methods, including thin-layer chromatography and infrared spectrophotometry, may be used to confirm the findings. Each analysis requires about 7 hours of study. Residue in water samples is determined at levels down to parts per billion; in soil and other samples, down to parts per million.

Only a portion of each soil sample collected is used in the chemical analysis. The remainder is sealed and stored in a special building, where it is available for further testing. In addition extracts of all samples are retained for reference purposes.

This present monitoring program in the Delta will continue for at least 3 years. Additional programs are being planned by the Agricultural Research Service. Sampling has already begun in two areas in the Red River Valley of North Dakota and Minnesota, where potatoes and sugar beets are major crops. Two areas have been selected at Yuma, Ariz., where emphasis centers on pesticide practices involved with the production of alfalfa, cotton, and truck crops.

Results Unfold on Paper

ANY PESTICIDE RESIDUES occurring in the original samples will be represented in the few drops of extract contained in this hypodermic syringe (left). The extract is injected into a highly sensitive gas chromatograph machine (immediately below). BN–23720; BN–23725

MINUTES LATER, the gas chromatograph records pesticide content—both kind and amount—of the extract on graph paper. Residue in water samples can be determined at levels down to parts per billion; in other samples, to parts per million. Other methods of analysis are used to verify the findings of the gas chromatograph. BN–23718

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